THE UNIVERSITY OF ALBERTA

THE USE OF DIFFERENTIAL APTITUDE TEST SCORES IN COUNSELLING FOR THREE HIGH SCHOOL PROGRAMS

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL, 1969

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled The Use of Differential Aptitude Test Scores in Counselling for Three High School Programs, submitted by Annie S. Dixon in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this study has been to examine the possible use of the Differential Aptitude Test battery in counselling grade nine students into the Academic, Business or Vocational programs in high school. In the spring of 1968 the eight subtests were administered to one hundred and twenty-four grade nine students in a centralized school system. These constitute the predictors. The 1969 final examination results in the compulsory subjects, English 10 and Social Studies 10, were taken as the criteria. The regression analyses indicated that beyond the inclusion of three or four variables there was small and diminishing amounts of prediction for either criterion. It was concluded therefore that the Differential Aptitude Tests, as used in this research, have only very moderate predictive value.

ACKNOWLEDGEMENTS

Of all the people who gave assistance to this research project, the writer wishes to thank in particular: Dr. D. Fair for his patience, direction and encouragement; Dr. K. Smillie for his many constructive suggestions; Dr. D. Sawatzky for his thoughtful consideration; and to Mrs. D. Haverstock for typing so skillfully.

The writer would also like to thank the St. Albert High School: Board, staff and students for their cooperation and interest. Also members of the Educational Research Service who willingly gave of their time.

Then singular thanks to family and friends who waited patiently for letters that often did not arrive while the writer was engaged in work on this thesis.

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CHAPTER I

INTRODUCTION

Differential Aptitude Tests are used only to some extent in grade nine for educational and vocational planning. Yet they represent an approach that is particularly valuable because they permit identification not only of the generally superior youngster but also of the pupil who has definitely strong assets along some lines and only moderate or low abilities in others. They do permit more or less discrete abilities to show themselves and they include some tests which have relatively low reading requirements.

The Differential Aptitude Tests were developed as a purposeful step away from the single all-embracing comprehensive IQ score. These tests came into being because the authors and their colleagues were convinced that while there were tests of achievement or general educational development available, there was an absence of an integrated battery of aptitude tests. These tests have become a helpful battery in high school due to the care taken in their development and norming and in the preparation of the manual. The information obtained from them can help the student get a better picture of potentialities within a framework of a large reference group (manual norms) or within his own school system (local norms). Bennett, Seashore and Wesman (1951) in fact say:

> This statement can be a general guide: Use aptitude tests and achievement records as predictors of the probable level of success in those aspects of the careers which depend on academic and special abilities. [p. 15]

The manual presents the coefficients of correlation between eight DAT scores and several well known tests of mental ability. In general, the verbal score correlates highly with verbally-loaded intelligence tests. But it is apparent that an attempt to obtain a rating on more than one of the facets of the mind would provide more meaningful information for guidance purposes than would a single score.

Furthermore, it is possible that these scores could be of even greater specific value--the Differential Aptitude Test battery was given, in this study, the additional role of assisting in the selection of the appropriate high-school curriculum in local schools. This research examines the relationship of specific aptitude scores to each of the three high school programs: academic, business and vocational. Regression equations investigate the possibility of determining which of the three common routes in high school would appear best suited to the individual student. These relationships may thus function in the practical situation of helping to plan a student's high school career commensurate with his abilities.

CHAPTER II

SOME PERTINENT LITERATURE

Wesman (1956) as one of the co-authors of the Differential Aptitude Tests, states:

> Any test is helpful or harmful only as it is used properly or misused. The test user should ask "What inferences do I want to make; what information do I need to make those inferences?" The user who answers those questions will show intelligence, achievement of proficiency in test usage and special aptitude for further advances in psychometrics.

He goes on to state:

> The differential aptitude test batteries include measurements of verbal and numerical aptitude, just as the scholastic aptitude intelligence tests do but they provide measures of other aptitudes as well--spatial, mechanical, clerical, and the like. The instruments yield a set of scores which recognize intra-individual differences.

And at another point he writes:

> Interest in broad and varied criteria is greatest in the secondary level, where the pupil reaches points of decision. At this time, the pupil and the school should be considering what kind of curriculum is best for him, what are appropriate directions and levels of aspiration for the immediate and the more distant future. Educational and vocational guidance are of tremendous importance; therefore, the broadest scope of ability testing is both desirable and eminently worthwhile. The choices to be made may well set the pattern of the student's life; information to help guide those choices warrants any additional expenditure of minutes and pennies. [pp. 4-6].

The manual for the Differential Aptitude Tests is comprehensive and easy to understand. Research quoted is

recent and is not limited to only the extremely favorable evidence. The forms L and M are normed on more than 50,000 students in 95 communities in 43 states enrolled in grades 8 through 12; the norms are expressed as percentiles and/or stanines.

Too, the manual cites many studies on both concurrent and predictive validity. Differential Aptitude Test scores were correlated with achievement in various areas: English, Mathematics, Science, Social Studies, languages, commercial courses and industrial arts. The coefficients of correlation between scores of the DAT (form A) subtests and English and Social Studies were: Verbal Reasoning 0.41 and 0.38, Numerical Ability 0.45 and 0.40, Abstract Reasoning 0.29 and 0.25, Space Relations 0.15 and 0.18, Mechanical Reasoning 0.12 and 0.09, Clerical Speed and Accuracy 0.07 and 0.19, Language Usage (Spelling) 0.38 and 0.30, Language Usage (Sentences) 0.42 and 0.37 [p. 5-54].

All the subtests are correlated with other standard tests of achievement and aptitude. The manual quotes four forms of reliability: test-retest with no time interval [p. 6-3], split-half coefficients [p. 6-6], standard errors of measurement [p. 6-7], and test-retest with a three year interval [p. 6-8]. The battery tries to test several aptitudes,

not a single one and the interpretation is placed on differences between the various scores rather than on the score itself.

Jacobs (1959) carried out a study evaluating the effectiveness of certain of the Differential Aptitude Tests along with other tests in predicting academic success in three Cincinnati public high schools. He used four of the Differential Aptitude Test (DAT) subtests: Verbal Reasoning, Numerical Ability, Mechanical Reasoning and Language Usage, as well as the English and Arithmetic Proficiency subtests of Metropolitian Achievement Tests and the German-McNemar Test of Mental Ability (a verbal general intelligence test) as the predictors administered in grade nine. The criterion measures were the total grade point averages in various subjects taken from grades ten through twelve; along with scores on the Essential High School Content Battery (EHSCB).

The correlations of the grade point averages with the DAT subtests ranged from 0.310 to 0.657 for the boys, while for the girls the range was between 0.437 and 0.716. The correlations of the DAT subtests with the Essential High School Content Battery ranged from 0.125 to 0.527 for the boys while the range for the girls was 0.167 to 0.654. Jacobs explains the generally higher relationships between the test predictors and the criterion among the girls than among the boys as probably due to the larger number of drop-outs associated

with boys thus leaving a more homogeneous group. His conclusions, in view of the findings, were:

> 1. The subject areas in which the highest prediction occured were English, mathematics, science and social studies or what are commonly known as "tool" studies. Vocational subjects areas were predicted less well.
>
> 2. In general, quantitative measures seemed to be better predictors of grade point averages in subject areas, while verbal tests were better predictors of the EHSCB criteria. The Terman-McNemar Test proved to be a good predictor of success for both types of criteria.
>
> 3. On the whole, girls represent a more predictable group than do boys.
>
> 4. The Terman-McNemar Test of Mental Ability and the Arithmetic Proficiency Test of Metropolitian Achievement Tests make an effective pair of predictors of high school achievement. [p. 341].

A similar study was done by Layton and Swanson (1958), showing the relationship of Differential Aptitude Test scores in grade nine to achievement test scores in specific grade eleven subjects. The authors state that the purpose of the study was:

> ...to extend the existing information bearing on the usefulness of the DAT for predicting long-term academic success. Originally the DAT was included in the Minnesota State Wide Testing Program to give the high school counselor measures of special aptitudes to use in conjunction with measures of academic ability. However, it has always been implicitly understood that the DAT was perhaps the most useful in predicting academic success. [p. 153].

The authors found that the scores on the Verbal Reasoning and

Numerical Ability were the best predictors of academic rank more than two years later and some of the other tests show substantially lower correlations with high school rank. But they point out that this does not mean that these tests would not contribute significantly in the prediction of performances other than academic success. In fact, they comment:

> The relationships make the DAT even more important in...guidance...where grades, test scores and other background information indicate that a ninth grader does not have good college potential [p. 155].

Thus these authors conclude that the DAT battery is helpful in counselling both the college bound and the non-college bound students.

Seashore (1954), one of the authors of the Differential Aptitude Tests, reports on the validation of Aptitude tests for counselling senior students regarding their educational plans. A major decision in early high school years is whether or not to undertake a college preparatory course. This study is chiefly concerned with that per cent of the school's students who go to college and it posed the following questions:

1. How well do tests given in the early years of high school, in this case grade 10, predict overall academic success?

2. How well do tests predict differential achievement in the curricula or major groupings of courses which these students complete?

> 3. How well do tests given in high school predict status in grade 12 on typical college entrance tests?
>
> 4. Can we predict actual college success from grade 10 testing as well as we can from grade 12 testing? [p. 106].

Here in the White Plains High School (Westchester County, New York) advisement in the tenth grade was based in part on the DAT tests. Seashore's intercorrelations among these tests and ACE Psychological Examination given in the Senior year ranged from 0.31 to 0.67 for the boys and from 0.19 to 0.68 for the girls. The intercorrelations of the DAT scores with the CEEB Scholastic Aptitude Test varied from 0.23 to 0.71 for the boys and from 0.07 to 0.69 for the girls. In analyzing these data it appears that scores on the DAT: Verbal Reasoning, Numerical Ability and Language Usage (Sentences) secured in grade 10 are generally better predictors than the ACE. This is clearly true for boys but less so for girls. For the criteron (four-year grade average) the DAT verbal tests (Verbal and Sentences) and the DAT Numerical test are the best predictors of all-around scholastic achievement. And if Scholastic Aptitude Tests are important for college admission there is reason to make greater use of grade 10 DAT scores in educational counselling.

Besides looking at the relative values of certain tests in relation to over-all academic status with no reference

to specialized curricula Seashore also analyzed prediction in three curricular groups: College Preparatory, General and Commercial for the girls along with Practical Arts for the boys. The DAT scores, in grade 10, on the Verbal, Numerical and Language Usage tests are more effective predictors of final grade status for boys in the College Preparatory than are the ACE scores; for the girls both are about equally predictive. The less academic tests--Abstract, Space and Mechanical show less relationship for the girls than for the boys. The tests were generally less predictive of grades for both boys and girls in the General category than in the collegiate category. In the Practical Arts, the best predictors were the nonverbal tests with Numerical, Abstract, Space Mechanical and Clerical being the best. In the Commercial category for the girls, Spelling was the only test on which the group reached the 50th percentile. Seashore summarized his general conclusions as:

> Aptitude tests administered early in high school, in this case grade 10, are valuable in counseling students with respect
> a) to their expected general academic status,
> b) their expected status within certain curricular groups, and
> c) their expected status on two well-known senior-year measures of scholastic aptitude which are considered important by many colleges in evaluating applicants for admission. [p. 114]

A parallel study, but on the prediction of university grades from Differential Aptitude scores in grades nine and

eleven, was done by Harris and Dole (1956). This investigation is concerned with the effectiveness of this test battery as a tool for counselling high school students and predicting their academic success at the University of Hawaii. The coefficients of correlation between grade nine DAT scores and grade eleven Academic Rank ranged from 0.24 (Mechanical Reasoning) to 0.57 (Numerical Ability) for the boys and 0.15 (Clerical Speed and Accuracy) to 0.58 (Verbal Reasoning) for the girls. The correlation coefficients of DAT scores in grade eleven with College Freshman Year Grade Point Average were 0.15 (Language Usage: Spelling) to (Language Usage: Sentences) with 0.56. The authors note that two of the grade eleven scores on the DAT forecast college success as effectively as did the grade twelve scores on the college admission tests. Following this study the Department of Public Instruction adopted the Differential Aptitude Tests as the basic guidance battery in grade nine throughout the Territory, and the University planned a more elaborate study including separate analyses for men and women and for its several colleges and major departments.

Another such study, using prediction in vocational schools, was performed by Doppett, Seashore and Odgers [p. 648-655]. For auto-mechanics students, the highest correlation was found to be the Differential Aptitude subtest

Language Usage: Spelling with the ratings on Understanding Trade Information. While for the machine-shop students the study of the combinations of scores resulted in the selection of the sum scores on the Differential Aptitude subtests: Mechanical Reasoning, Space Relations and Abstract Reasoning for predictors of the ratings. These findings closely resemble Houska's (1963) comparisons of the DAT and Scholastic Achievement.

Still more recent, unpublished studies consist of: Meyers (1958) on a comparison of Differential Aptitude Test patterns of junior college students in five semi-professional fields; Yagjian (1960) with a validation study of the Differential Aptitude Tests in relation to first year high school vocational bookkeeping in two communities; Eward (1961) researched the relationship of scores on the Differential Aptitude Tests to scholarships in high school and freshman college; and Foote (1960) found that the Differential Aptitude Tests did give a prediction of success in an Automotive Mechanics course in a Vocational-Industrial Curriculum at the secondary school level.

The Differential Aptitude Test battery provides a broader coverage of mental functioning than is obtainable from the more limited scholastic aptitude test. Bennett, Seashore and Wesman (1952) affirm:

> The Differential Aptitude Tests reveal important profile differences among high school students who enter diverse occupational and educational careers. Further, those abilities which counselors would expect to be distinctive in particular groups are actually found to be outstanding. It is apparent that the characteristics of high school students, measured by the Differential Aptitude Tests, bear important relations to their sequent careers, as reported almost eight years later. These findings lend support to current counselling practices in general and provide some specific suggestions for improved test interpretation. [p. 593]

Research with Differential Aptitude Tests has been extensive but along slightly different lines than to help demonstrate possible predictors of the probable level of success in the academic, business or vocational high school programs.

CHAPTER III

STRUCTURE OF THE INVESTIGATION

Purpose of the Study

Specifically, the present study focuses on the following basic question: how may the Differential Aptitude Test scores be of assistance to counsellors and to students in that important decision of the appropriate high school program?

At the end of grade nine the student and the school should be considering what kind of curriculum is best for him, also what are appropriate directions and levels of aspiration for the immediate and for the more distant future. The choices to be made at this time may well set the pattern of the student's life and any information to help guide these choices warrants additional consideration.

In the past, the results from the grade nine Departmental Examinations were practically supreme in making the decision regarding a student's program in high school. But with the recent revamping of the junior high school curriculum the directive is that these examinations "will no longer be regarded as the final arbiter." Certain examinations are to be provided but their results will be used as "guide-lines" when the school evaluates the student's work at the end of the year. The amount of attention to be paid to

particular results will be left strictly up to the individual school.

Thus, teachers, counsellors and administrators are going to be paying more attention to their own carefully planned within school testing programs and looking to a more thorough utilization of the results of all tests. The information yielded by aptitude tests may well be incorporated into the planning of differentiated instruction. They may also enrich the bases for personal counselling of all the students for whom discrepancies in case data are apparent. Hence the interpretation of an aptitude inventory may aid the school in working for a more rational utilization of the abilities of each and every student. The challenge is then--which aptitudes basically differentiate those students most likely to benefit from an Academic, Business or Vocational Program in a high school?

Procedure Followed

The Differential Aptitude Test Battery (all eight of the subtests) for one hundred twenty-four grade nine students (1967-68) were used as the predictors for the study. Their achievement (1968-69) in the compulsory subjects of English 10 and Social Studies 10 was used as the criteria. This group of students consists of seventy-four girls and fifty boys; the largest proportion (sixty-five) are in the

academic high school program, with thirty in business education and twenty-nine in the vocational route. Their sets of scores (predictors and criterion) were correlated for each of the three programs. Multiple stepwise regression equations were calculated for each criterion in each route. For each variable entering, its F value is shown as well as the probability level, percent variance accounted for (the coefficient of determination or multiple R's) and the standard error of the predicted criterion along with the regression weights and constant. Both the 5 percent and 1 percent significance levels are given for the F-ratios.

CHAPTER IV

PRESENTATION OF THE ANALYSES OF THE DATA AND RESULTS

For each of the criteria, English 10 and Social Studies 10, with the eight Differential Aptitude subtests as predictors, the scores were processed with the Stepwise Multiple Regression Program MULR 06 prepared by the Educational Research Services, on the IBM System /360, Model 67 in the Computing Centre, University of Alberta.

Correlation analyses here revealed and measured the relationships between the predictors and each criterion. The regression equations predicted the most likely measurement in English 10 and Social Studies 10 from the scores of the subtests. As long as the relationship was limited to that between two variables, Step 1 in each case, it was approximated by the straight line $Y^1=a + bX$, where Y^1 represented the estimated value of the dependent variable Y, given the independent variable X. The constant a represented the value of Y^1 when X is zero, and b constant, the coefficient of regression, gave the slope or the amount of change in the Y^1 associated with a unit change in X. The margin of error (how far on the average that the prediction would miss) was summarized by the standard error.

As other predictor variables were entered according to their contribution (successive steps after the first) the analysis determined the consecutive combinations which produced the maximum possible correlation between the criterion variables, English 10 or Social Studies 10, and the weighted sum of two or more of the predictor variables. This relationship could no longer be represented by a straight line and has to be pictured spatially as a regression surface or as a multi-dimensional figure. Mathematically, for a three-variable problem the regression equation has the form

$$Y^1 = a + b_1 X_1 + b_2 X_2 + b_3 X_3$$

The estimated Y^1 at a given point of the regression surface was determined by specified values of X_1, X_2 and X_3 and corresponds to the Y^1 in the simple correlation.

In the examination of the regression analysis, entry of variables only to the probability level of 0.35 was used. In each instance this measure corresponds quite closely to the minimum value of the standard error of the predicted criterion. Beyond this level little of anything would be gained by employing the regression for making estimates.

A summary of the importance of the independent variables, namely the rank order of their contribution, is shown for the criterion English 10 in Table 1 which follows.

Table I

ORDER OF ENTRY OF PREDICTORS FOR ENGLISH 10

Predictors	The High School Routes		
	Academic	Business	Vocational
X_1: Verbal	3	3	5
X_2: Numerical	5	2	2
X_3: Abstract	7	4	4
X_4: Space	4	7	6
X_5: Mechanical	6	8	3
X_6: Clerical	2	5	7
X_7: Lang. U. (Sp.)	8	6	8
X_8: Lang. U. (Sent.)	1	1	1

This table shows that there is one common predictor of English 10 for all the three high school programs namely the subtest English Usage: Sentences. Then the pattern varies with Numerical Ability ranking second in the Business and Vocational routes followed by Verbal Reasoning in the Academic and Business. Abstract Reasoning ranks fourth for Business and Vocational ending the extent of co-efficiency.

Table 2 gives the rank order of the entry of the predictors for Social Studies 10 for the three programs or

routes.

TABLE II

ORDER OF ENTRY OF PREDICTORS OF SOCIAL STUDIES 10

Predictors	The High School Routes		
	Academic	Business	Vocational
X_1: Verbal	5	8	5
X_2: Numerical	1	1	8
X_3: Abstract	8	7	3
X_4: Space	6	6	4
X_5: Mechanical	7	4	2
X_6: Clerical	2	3	6
X_7: Lang. U. (Sp.)	4	5	7
X_8: Lang. U. (Sent.)	3	2	1

No one subtest held the same rank of prediction for Social Studies 10 in all the three routes. Numerical Ability was first for the Academic and Business but there the co-efficiency ceased until the fifth and sixth rankings.

The relevant statistics for the strongest predictors, in each of the three high school programs are examined in turn. The complete data of the Stepwise Regression analysis are presented in Appendices A, B and C.

TABLE III

CORRELATION MATRIX FOR ACADEMIC ROUTE: N = 65

	Predictors	English 10: Y_{A1}	Social Studies 10: Y_{A2}	
X_1	Verbal R.	0.33	0.25	Mean: 82.29 S.D.: 15.16
X_2	Numerical A.	0.35	0.32	Mean: 72.65 S.D.: 25.25
X_3	Abstract R.	0.22	0.17	Mean: 84.15 S.D.: 13.60
X_4	Space R.	-0.03	0.14	Mean: 66.60 S.D.: 21.82
X_5	Mechanical R.	0.03	0.12	Mean: 69.52 S.D.: 23.55
X_6	Clerical S. & A.	0.35	0.26	Mean: 72.51 S.D.: 22.73
X_7	Lang. Usage: Sp.	0.15	0.03	Mean: 76.75 S.D.: 19.52
X_8	Lang. Usage: Sent.	0.40	0.30	Mean: 71.55 S.D.: 19.22
		Mean: 70.77 S.D.: 10.72	Mean: 70.08 S.D.: 12.80	

Academic Route N = 65

A. Predicting English 10, Academic Route: Y^1_{A1}

The correlation matrix and the means and standard deviations are shown in Table 3.

The criterion, English 10 Academic was labelled Y_{A1} and Social Studies 10 Academic as Y_{A2}. The predicted values for each were Y^1_{A1} and Y^1_{A2} respectively. The predictor variables were designated as follows: Verbal Reasoning, X_1; Numerical Ability, X_2; Abstract Reasoning, X_3; Space Relations, X_4; Mechanical Reasoning, X_5; Clerical Speed and Accuracy, X_6; Language Usage (Spelling), X_7; and Language Usage (Sentences), X_8.

The correlation coefficients were not high though they do compare relatively well with those of Bennett, Seashore and Wesman (1959, p. 54). Their range with English and the Differential Aptitude subtests was from 0.07 to 0.42.

The results of the regression analysis for the Academic Route is shown in Table 4.

Table 4 contains the necessary statistics for the formation of from one to four equations with which to predict likely scores in English 10. The entry of each predictor, with its weight or regression coefficient corresponds to the steps shown. The reader may form regression equations from any one of the given steps to his chosen or desired limit of variation added; to the minimum of the standard error of the predicted criterion or to a certain probability level, as he so wishes. The standard error of the predicted criterion, here Y^1_{A1}, was the range of the difference between the actual

TABLE IV

RESULTS OF REGRESSION ANALYSIS FOR PREDICTION OF ENGLISH 10, ACADEMIC ROUTE

		Step 1	Step 2	Step 3	Step 4
Regression Coefficients	Constants	54.67	45.21	36.44	38.76
	X_8	0.225 (0.064)*	0.208 (0.061)	0.161 (0.066)	0.163 (0.066)
	X_6		0.147 (0.052)	0.150 (0.051)	0.152 (0.051)
	X_1			0.145 (0.083)	0.159 (0.084)
	X_4				-0.056 (0.054)
	Standard Error of Y^1_{A1}	9.892	9.382	9.232	9.236
	F-value	12.22	10.81	8.45	6.61
	Probability level	0.001	0.006	0.087	0.304
	% variation added	16.2	9.6	3.6	1.2
	Total % added	16.2	25.8	29.4	30.6

Note.--Critical value of F of 3.03 at 5% and 5.06 a5 1%
* standard error of regression coefficients show in parentheses

values of the criterion score and those estimated from the regression equation. The probability level gave the chance that the predicted value of an English 10 score could have been taken at random. The multiple R measures the degree of relationship or association between the Differential

Aptitude subtests and the scores in English 10 (and further on with Social Studies 10).

Step 1 provided this equation

$$Y^{1}_{A1} = 54.67 + 0.255\ X_{8}$$

which predicts the mark of English 10, Academic from a student's score on the Language Usage (Sentences) subtest. Accordingly Step 4 produced

$$Y^{1}_{A1} = 38.76 + 0.162X_{8} + 0.151X_{6} + 0.159X_{1} - 0.056X_{4}$$

and here the criterion score was predicted with the contributions of four Differential Aptitude subtests. Carrying the equation to further steps seemed little more than a mathematical exercise for any one of the following reasons: the probability level was 30%, the standard error of the Y^{1}_{A1} was increasing after a minimum, the multiple R shows that the variables were contributing a negligible amount to the efficacy of prediction, also the variation added was approaching 31%.

B. Predicting Social Studies 10, Academic Route: Y^{1}_{A2}

The summarized results of the regression analysis for Social Studies 10 in this high school program follows in Table 5.

Here the equation of the line of regression from Step 1 which predicted Social Studies 10 was

$$Y^{1}_{A2} = 58.23 + 0.163\ X_{2}$$

TABLE V

RESULTS OF REGRESSION ANALYSIS FOR PREDICTION OF SOCIAL STUDIES 10, ACADEMIC ROUTE

		Step 1	Step 2	Step 3	Step 4
Regression Coefficients	Constants	58.23	51.11	45.52	
	X_2	0.163 (0.064)*	0.143 (0.061)	0.101 (0.067)	0.121 (0.071)
	X_6		0.118 (0.067)	0.117 (0.068)	0.108 (0.067)
	X_8			0.122 (0.087)	0.133 (0.088)
	X_7				-0.073 (0.085)
	Standard Error of Y^1_{A2}	12.21	12.01	11.92	11.94
	F-value	7.28	5.31	4.25	3.36
	Probability level	0.009	0.083	0.167	0.393
	% variation added	10.4	4.2	2.7	1.0
	Total % added	10.4	14.6	17.3	18.3

Note.--Critical value of F of 3.03 at 5% and 5.06 at 1%
* standard error of regression coefficients shown in parentheses.

and the steps and explanations parallel those for English 10.

Also continuing the calculation of equations beyond Step 3

which gave

$$Y^1_{A2} = 45.52 + 0.101X_2 + 0.117X_6 + 0.122X_8$$

would seem irrelevant for the same reasons as listed in

regards English 10, Academic.

Business Route

The sample size was thirty and the same procedure has been followed as was designed for the Academic Route. The correlation Matrix with means and standard deviations are shown in Table 6. The criterion English 10, Business was indicated Y_{B1} and Social Studies 10, Business was labelled Y_{B2}. The predictors are the same subtests X_1, $X_2 \ldots X_8$ as in the Academic Route.

Table VI follows on Page 26.

TABLE VI

CORRELATION MATRIX FOR BUSINESS ROUTE: N = 30

	Predictors	English 10: Y_{B1}	Social Studies 10: Y_{B2}	
X_1	Verbal R.	0.46	0.10	Mean: 44.67 S.D.: 22.66
X_2	Numerical A.	0.42	0.32	Mean: 44.00 S.D.: 27.68
X_3	Abstract R.	0.29	0.20	Mean: 58.40 S.D.: 26.93
X_4	Space R.	0.08	0.15	Mean: 43.20 S.D.: 26.84
X_5	Mechancial R.	0.15	0.15	Mean: 45.37 S.D.: 29.68
X_6	Clerical S. & A.	0.22	0.20	Mean: 53.47 S.D.: 28.87
X_7	Lang. Usage: Sp.	0.20	0.13	Mean: 43.67 S.D.: 27.63
X_8	Lang. Usage: Sent.	0.51	0.21	Mean: 36.67 S.D.: 25.02
		Mean: 52.17 S.D.: 7.51	Mean: 50.33 S.D.: 7.98	

A. Predicting English 10, Business Route Y^{1}_{B1}

The results of the regression analysis for predicting English 10, Business Route follows in Table 7 with the complete data on the eight steps found in Appendix B.

TABLE VII

RESULTS OF REGRESSION ANALYSIS FOR PREDICATION OF ENGLISH 10, BUSINESS ROUTE

	Step 1	Step 2	Step 3	Step 4
Regression Coefficients				
Constants	45.53	43.52	40.55	41.25
X_8	0.154 (0.049)*	0.133 (0.047)	0.084 (0.054)	0.080 (0.054)
X_2		0.090 (0.042)	0.097 (0.041)	0.115 (0.047)
X_1			0.100 (0.058)	0.129 (0.068)
X_3				-0.044 (0.055)
Standard Error of Y^{1}_{B1}	6.56	6.19	5.98	6.02
F-value	9.98	4.46	2.96	0.66
Probability level	0.004	0.044	0.097	0.424
% variation added	26.3	11.4	5.5	1.4
Total % Added	26.3	37.7	43.2	44.6

Note.--Critical value of F of 3.15 at 5% and 5.36 at 1%
* standard error of regression coefficients show in parentheses.
Total % variance/100 = R^2

B. Predicting Social Studies 10, Business Route Y^{1}_{B2}

The summarized results of the regression analysis for Social Studies follows in Table 8.

TABLE VIII

RESULTS OF REGRESSION ANALYSIS FOR PREDICTION OF SOCIAL STUDIES 10, BUSINESS ROUTE

		Step 1	Step 2	Step 3	Step 4
Regression Coefficients	Constants	46.40	45.03	43.96	43.06
	X_2	0.094 (0.052)*	0.085 (0.053)	0.081 (0.054)	0.078 (0.055
	X_8		0.048 (0.059)	0.038 (0.062)	0.035 (0.063)
	X_6			0.030 (0.053)	0.029 (0.054)
	X_5				0.026 (0.050)
	Standard Error of Y^{1}_{B2}	7.68	7.73	7.83	7.94
	F-value	3.30	0.66	0.31	0.25
	Probability level	0.080	0.42	0.58	0.62
	% variation added	10.5	2.2	1.0	0.9
	Total % added	10.5	12.7	13.7	14.6

Note.--Critical value of F of 3.15 at 5% and 5.36 at 1%
* standard error of regression coefficients shown in parentheses

Vocational Route

The sample size of this route was twenty-nine and Table 9 portrays the correlation matrix with means and standard deviations of the criteria English 10, Vocational Y_{V1} and Social Studies 10, Vocational Y_{V2} with the predictors X_1, X_2,...X_8 as in the other two routes.

The results of the regression analysis for predicting English 10 Vocational Y'_{V1} are shown in Table 10 with the complete steps in Appendix C and the predictions of Social Studies 10 Vocational Y'_{V2} in Table 11.

Tables 9, 10 and 11 follow on pages 30, 31 and 32 respectively.

TABLE IX

CORRELATION MATRIX FOR VOCATIONAL ROUTE: N = 29

	Predictors	English 10: Y_{V1}	Social Studies 10: Y_{V2}	
X_1	Verbal R.	0.18	0.09	Mean: 39.14 S.D.: 20.49
X_2	Numerical A.	0.41	0.32	Mean: 28.14 S.D.: 21.51
X_3	Abstract R.	-0.14	0.13	Mean: 53.17 S.D.: 26.21
X_4	Space R.	-0.05	-0.15	Mean: 49.38 S.D.: 28.47
X_5	Mechanical	-0.19	0.18	Mean: 53.10 S.D.: 24.14
X_6	Clerical S. & A.	0.16	-0.02	Mean: 66.34 S.D.: 22.18
X_7	Lang. Usage: Sp.	0.38	0.22	Mean: 28.76 S.D.: 19.66
X_8	Lang. Usage: Sent.	0.59	0.44	Mean: 25.03 S.D.: 15.63
		Mean: 46.03 S.D.: 6.60	Mean: 48.10 S.D.: 6.74	

TABLE X

RESULTS OF REGRESSION ANALYSIS FOR PREDICTING ENGLISH 10, VOCATIONAL Y^1_{V1}

		Step 1	Step 2	Step 3	Step 4
Regression Coefficients	Constants	39.78	38.75	42.70	45.22
	X_8	0.250 (0.065)*	0.215 (0.070)	0.177 (0.070)	0.145 (0.075)
	X_2		0.068 (0.050)	0.113 (0.056)	0.148 (0.062)
	X_5			-0.082 (0.046)	-0.082 (0.046)
	X_3				-0.049 (0.044)
	Standard Error of Y^1_{V1}	5.42	5.34	5.13	5.10
	F-value	14.55	1.79	3.13	1.29
	Probability level	0.001	0.193	0.089	0.268
	% variation added	35.0	4.2	6.8	2.7
	Total % added	35.0	39.2	46.0	48.7

Note.--Critical F of 3.18 at 5% and 5.45 at 1%
* standard error of regression coefficients shown in parentheses.

TABLE XI

RESULTS OF REGRESSION ANALYSIS FOR PREDICTING SOCIAL STUDIES 10, VOCATIONAL Y^{1}_{V2}

Regression Coefficients	Step 1	Step 2	Step 3	Step 4
Constants	43.36	39.70	37.68	38.87
X_8	0.190 (0.074)*	0.200 (0.074)	0.211 (0.075)	0.197 (0.078)
X_5		0.064 (0.048)	0.052 (0.049)	0.062 (0.051)
X_3			0.044 (0.046)	0.052 (0.047)
X_4				-0.035 (0.045)
Standard Error of Y^{1}_{V2}	6.16	6.07	6.08	6.13
F-value	6.48	1.79	0.93	0.61
Probability level	0.017	0.193	0.345	0.444
% variation added	19.3	5.2	2.7	1.8
Total % added	19.3	24.5	27.2	29.0

Note.--Critical F of 3.18 at 5% and 5.45 at 1%
* standard error of regression coefficients shown in parentheses

Summary

This chapter has presented data pertinent to the relationship of the Differential Aptitude Tests to the compulsory high school subjects, English 10 and Social Studies 10. The correlation matrices and the regression analyses examined the association of these subjects with the three common high school routes. Data have been provided for forming regression equations for prediction of each dependent variable in each of the routes. Several statistical methods were given with which to decide when the entry of succeeding variables contributed a negligible amount to the efficacy of the prediction. The complete eight steps for each criterion in each route can be consulted in Appendices A, B and C.

CHAPTER V

DISCUSSION

The results of this study, while interesting to the writer and of possible interest to counsellors, teachers and administrators can not be used as the "decision-maker" for promotion procedures to each of the three high-school programs. The analyses computed can not be used as an instrument for general premises about this specific set of circumstances in the school. The regression equations can not act as a magic device to assist with a student's decision in regard to the most suitable high school program.

The prediction through multiple regression was not found to be superior. The correlations were low. This may have been quite sure that the resultant coefficient was not the result of random errors of sampling. For a sample of this size the coefficients, to have been significant, would have to have been around 0.70. These requirements were not achieved. Hence the computed equations can not safely prescribe or specify particular occupational areas nor specific courses of study. They could be used as auxiliary or supplemental information of some value in the prediction of future marks in the two compulsory high school subjects of English 10 and Social Studies 10. They can not be the

sole arbiter in the decisions of the student, counsellor or the administration.

However, the raw scores of these sets of predictor tests did by themselves provide useful information. As a group of scores depicting a pattern they furnished considerable additional meaning. The academic group generally scored highest on Verbal Reasoning, Numerical Ability and Language Usage (Sentences and Spelling). The business group excelled in general on the Clerical Speed and Accuracy while they were strong or above average in the verbal and language abilities. The scores of the vocational route, although scholastically inferior, were of such superiority in Mechanical Aptitudes as to warrant special attention. It would thus appear that the considerations of the patterns of scores could be of some assistance in the selection by pupils of appropriate courses and curricula.

A challenge for future research could be along the same lines as this study but with an expanded sample to increase the reliability. The data might be combined from several successive samples to eliminate the influence of accidental preculiarities. Similar data might be computed for the whole spectrum of the high school program, not just these two compulsory subjects. For example the vocational subjects requiring approximate aptitudes to the Mechanical

Reasoning and Space Relations might correlate more readily with the shop options and produce equations with greater predictive efficiency. It might be though, that non-statistical criteria contributes more to predicting success in high school than does a battery of aptitude tests.

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APPENDICES

APPENDIX A

APPENDIX A

Stepwise Regression Route 1 A Dixon Mulro6 June 69

No. of Format Cards = 1
No. of Observations = 65
No. of Variables = 10
P Level to Add Variable = 1.000
P Level to Delete Variable = 1.000
Format (3X,8F2.0,3X,2F2.0)

RT1 English

No. of Predictors = 8
Criterion = Variable 9
New Designation of Criterion Variable = 9
Original Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	8
F Value For Variable Entering	12.222767
Probability Level	0.000871
Percent Variance Accounted For	16.248047
Standard Error of Predicted Y	9.892637

Analysis of Variance Table

Source of		SS	MS	F	P
Regres	1.	1196.113	1196.113	12.222	0.000871
Resid	63.	6165.449	97.864		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
8	0.403099	0.224951	0.064343

Constant = 54.673

****Step No. 2

Variable Entering	6
F Value For Variable Entering	8.031283
Probability Level	0.006196
Percent Variance Accounted For	25.852844
Standard Error of Predicted Y	9.382882

Analysis of Variance Table

Source of		SS	MS	F	P
Regres	2.	1903.176	951.588	10.809	0.000094
Resid	62.	5458.387	88.038		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
6	0.311346	0.146918	0.051842
8	0.373287	0.208315	0.061310

Constant = 45.211

****Step No. 3

Variable Entering	1
F Value For Variable Entering	3.033046
Probability Level	0.086613
Percent Variance Accounted For	29.364960
Standard Error of Predicted Y	9.232728

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	3.	2161.723	720.574	8.453	0.000088
Resid	61.	5199.840	85.243		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.205500	0.145338	0.083452
6	0.316867	0.149523	0.051034
8	0.288621	0.161067	0.066148

Constant = 36.443

****Step No. 4

Variable Entering	4
F Value For Variable Entering	1.075971
Probability Level	0.303759
Percent Variance Accounted For	30.609329
Standard Error of Predicted Y	9.226984

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	4.	2253.328	563.332	6.617	0.000177
Resid	60.	5108.234	85.137		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.224763	0.158961	0.084428
4	-0.113574	-0.055834	0.053827
6	0.321201	0.151568	0.051041
8	0.291826	0.162855	0.066129

Constant = 38.764

****Step No. 5

Variable Entering	2
F Value For Variable Entering	0.819608
Probability Level	0.368948
Percent Variance Accounted For	31.560074
Standard Error of Predicted Y	9.240887

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	5.	2323.316	464.663	5.441	0.000350
Resid	59.	5038.246	85.394		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.203231	0.143733	0.086212
2	0.113264	0.048112	0.053143
4	-0.106849	-0.052528	0.054032
6	0.303682	0.143301	0.051927
8	0.250111	0.139576	0.071045

Constant = 38.567

****Step No. 6

Variable Entering	5
F Value for Variable Entering	0.238361
Probability Level	0.627173
Percent Variance Accounted For	31.840195
Standard Error of Predicted Y	9.301116

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	6.	2343.937	390.656	4.516	0.000808
Resid	58.	5017.625	86.511		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.213754	0.151175	0.088103
2	0.112789	0.047910	0.053491
4	-0.088100	-0.043311	0.057568
5	-0.058112	-0.026464	0.054205
6	0.310272	0.146411	0.052652
8	0.249373	0.139164	0.071513

Constant = 38.999

****Step No. 7

Variable Entering	3
F Value For Variable Entering	0.052043
Probability Level	0.820279
Percent Variance Accounted For	31.902374
Standard Error of Predicted Y	9.378069

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	7.	2348.516	335.502	3.815	0.001833
Resid	57.	5013.047	87.948		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.204861	0.144886	0.093011
2	0.110386	0.046889	0.054119
3	0.035421	0.027977	0.122635
4	-0.102258	-0.050271	0.065574
5	-0.064419	-0.029336	0.056085
6	0.306681	0.144717	0.053604
8	0.243176	0.135706	0.073681

Constant = 38.270

****Step No. 8

Variable Entering	7
F Value For Variable Entering	0.014323
Probability Level	0.905171
Percent Variance Accounted For	31.919785
Standard Error of Predicted Y	9.460221

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	8.	2349.797	293.725	3.282	0.003871
Resid	56.	5011.766	89.496		
Total	64.	7361.562			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.205487	0.145328	0.093899
2	0.105169	0.044673	0.057648
3	0.034609	0.027335	0.123825
4	-0.099691	-0.049009	0.066983
5	-0.063720	-0.029018	0.056639
6	0.308889	0.145759	0.054770
7	0.014968	0.008226	0.068733
8	0.240661	0.134302	0.075246

Constant = 37.736

****No Further Steps Required End of This Job

RT1 Social

No. of Predictors = 8
Criterion = Variable 10
New Designation of Criterion Variable = 9
Original Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	2
F Value For Variable Entering	7.276162
Probability Level	0.008953
Percent Variance Accounted For	10.352218
Standard Error of Predicted Y	12.208787

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	1.	1084.379	1084.379	7.275	0.008957
Resid	63.	9390.434	149.054		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.321773	0.163042	0.060443

Constant = 58.232

****Step No. 2

Variable Entering	6
F Value For Variable Entering	3.102008
Probability Level	0.083109
Percent Variance Accounted For	14.623796
Standard Error of Predicted Y	12.010074

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	2.	1531.816	765.908	5.310	0.007436
Resid	62.	8942.996	144.242		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.281825	0.142800	0.060560
6	0.210503	0.118489	0.067275

Constant = 51.112

****Step No. 3

Variable Entering	8
F Value For Variable Entering	1.957200
Probability Level	0.166862
Percent Variance Accounted For	17.277954
Standard Error of Predicted Y	11.918422

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	3.	1809.836	603.279	4.247	0.008627
Resid	61.	8664.977	142.049		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.198934	0.100799	0.067179
6	0.208715	0.117483	0.066766
8	0.182953	0.121788	0.087054

Constant = 54.521

****Step No. 4

Variable Entering	7
F Value For Variable Entering	0.740549
Probability Level	0.392925
Percent Variance Accounted For	18.286499
Standard Error of Predicted Y	11.943849

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	4.	1915.480	478.870	3.357	0.015161
Resid	60.	8559.332	142.656		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.238299	0.120746	0.071201
6	0.191882	0.108007	0.067808
7	-0.111703	-0.073227	0.085093
8	0.199461	0.132777	0.088169

Constant = 49.594

****Step No. 5

Variable Entering	1
F Value For Variable Entering	0.385956
Probability Level	0.536775
Percent Variance Accounted For	18.817566
Standard Error of Predicted Y	12.005441

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	5.	1971.105	394.221	2.735	0.027383
Resid	59.	8503.707	144.131		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.081513	0.068767	0.110691
2	0.220637	0.111796	0.073004
6	0.197194	0.110997	0.068328
7	-0.106475	-0.069800	0.085709
8	0.172079	0.114549	0.093354

Constant = 45.409

****Step No. 6

Variable Entering	4
F Value For Variable Entering	0.172443
Probability Level	0.679435
Percent Variance Accounted For	19.058212
Standard Error of Predicted Y	12.090531

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	6.	1996.316	332.719	2.276	0.048505
Resid	58.	8478.496	146.181		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.090210	0.076104	0.112867
2	0.220306	0.111629	0.073522
4	-0.050861	-0.029826	0.071824
6	0.198216	0.111573	0.068826
7	-0.116292	-0.076235	0.087697
8	0.176606	0.117563	0.094296

Constant = 47.041

****Step No. 7

Variable Entering	5
F Value For Variable Entering	0.232194
Probability Level	0.631657
Percent Variance Accounted For	19.386597
Standard Error Of Predicted Y	12.171365

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	7.	2030.711	290.102	1.958	0.076967
Resid	57.	8444.102	148.142		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.078894	0.066558	0.115335
2	0.219946	0.111446	0.074015
4	-0.070774	-0.041503	0.076257
5	0.062966	0.034205	0.070984
6	0.191439	0.107758	0.069737
7	-0.113811	-0.074609	0.088348
8	0.176964	0.117801	0.094927

Constant = 46.374

****Step No. 8

Variable Entering	3
F Value For Variable Entering	0.006249
Probability Level	0.937267
Percent Variance Accounted For	19.395599
Standard Error of Predicted Y	12.278870

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	8.	2031.656	253.957	1.684	0.122560
Resid	56.	8443.156	150.771		
Total	64.	10474.812			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.082293	0.069425	0.121876
2	0.220697	0.111827	0.074823
3	-0.013485	-0.012705	0.160719
4	-0.065314	-0.038302	0.086941
5	0.065384	0.035518	0.073514
6	0.192872	0.108565	0.071089
7	-0.113345	-0.074304	0.089212
8	0.179240	0.119317	0.097666

Constant = 46.684

****No Further Steps Required End of This Job

APPENDIX B

APPENDIX B

Stepwise Regression Route 2 A Dixon Milro6 June 69

No. of Format Cards = 1
No. of Observations = 30
No. of Variables = 10
P Level To Add Variable = 1.000
P Level to Delete Variable = 1.000
Format (3X,8F2.0,3X,2F2.0)

RT2 English

No. of Predictors = 8
Criterion = Variable 9
New Designation of Criterion Variable = 9
Orignial Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	8
F Value For Variable Entering	9.977343
Probability Level	0.003779
Percent Variance Accounted For	26.271835
Standard Error of Predicted Y	6.559770

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	1.	429.331	429.331	9.977	0.003779
Resid	28.	1204.856	43.031		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
8	0.512560	0.153789	0.048688

Constant = 46.528

****Step No. 2

Variable Entering	2
F Value For Entering	4.461168
Probability Level	0.044063
Percent Variance Accounted For	36.726425
Standard Error of Predicted Y	6.188424

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	2.	600.179	300.089	7.836	0.002072
Resid	27.	1034.009	38.297		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.330465	0.089600	0.042421
8	0.444290	0.133305	0.046944

Constant = 43.516

****Step No. 3

Variable Entering	1
F Value For Variable Entering	2.960305
Probability Level	0.097211
Percent Variance Accounted For	43.194214
Standard Error of Predicted Y	5.975309

Analysis of Variance Table

Source Of		SS	MS	F	P
Regress	3.	705.875	235.292	6.590	0.001843
Resid	26.	928.313	35.704		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.300615	0.099567	0.057869
2	0.358171	0.097112	0.041192
8	0.280589	0.084188	0.053568

Constant = 40.554

****Step No. 4

Variable Entering	3
F Value For Variable Entering	0.657711
Probability Level	0.424999
Percent Variance Accounted For	44.650391
Standard Error of Predicted Y	6.015034

Analysis of Variance Table

Source Of		SS	MS	F	P
Regres	4.	729.671	182.418	5.042	0.004048
Resid	25.	904.516	36.181		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.388623	0.128717	0.068450
2	0.424194	0.115013	0.046975
3	-0.159341	-0.044410	0.054760
8	0.266239	0.079883	0.054185

Constant = 41.251

****Step No. 5

Variable Entering	6
F Value For Variable Entering	0.679167
Probability Level	0.417988
Percent Variance Accounted For	46.173599
Standard Error of Predicted Y	6.054007

Analysis of Variance Table

Source	Of	SS	MS	F	P
Regres	5.	754.563	150.913	4.118	0.007672
Resid	24.	879.624	36.651		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.449249	0.148797	0.073075
2	0.420803	0.114093	0.047292
3	-0.182876	-0.050970	0.055687
6	0.138819	0.036099	0.043804
8	0.199344	0.059811	0.059727

Constant = 39.582

****Step No. 6

Variable Entering	7
F Value For Variable Entering	0.495683
Probability Level	0.488452
Percent Variance Accounted For	47.309158
Standard Error of Predicted Y	6.118634

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	6.	773.121	128.853	3.442	0.014212
Resid	23.	861.067	37.438		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.425792	0.141027	0.074675
2	0.448842	0.121696	0.049002
3	-0.188337	-0.052492	0.056323
6	0.160657	0.041779	0.045000
7	-0.132807	-0.036076	0.051241
8	0.265251	0.079586	0.066579

Constant = 40.245

****Step No. 7

Variable Entering	4
F Value For Variable Entering	0.113399
Probability Level	0.739499
Percent Variance Accounted For	47.579361
Standard Error of Predicted Y	6.240086

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	7.	777.536	111.077	2.853	0.028125
Resid	22.	856.651	38.939		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.422262	0.139858	0.076237
2	0.453789	0.123037	0.050133
3	-0.145648	-0.040594	0.067437
4	-0.066750	-0.018670	0.055442
6	0.159016	0.041352	0.045911
7	-0.135894	-0.036914	0.052317
8	0.258061	0.077429	0.068202

Constant = 40.491

****Step No. 8

Variable Entering	5
F Value For Variable Entering	0.006726
Probability Level	0.935426
Percent Variance Accounted For	47.596146
Standard Error of Predicted Y	6.385910

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	8.	777.811	97.226	2.384	0.052909
Resid	21.	856.377	40.780		
Total	29.	1634.187			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.417363	0.138236	0.080487
2	0.455557	0.123516	0.051637
3	-0.146453	-0.040818	0.069067
4	-0.077611	-0.021708	0.067758
5	0.018309	0.004630	0.056451
6	0.156518	0.040702	0.047647
7	-0.135801	-0.036889	0.053541
8	0.259148	0.077755	0.069909

Constant = 40.500

****No Further Steps Required End of This Job

RT2 Social

No. of Predictors = 8
Criterion = Variable 10
New Designation of Criterion Variable = 9
Original Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	2
F Value For Variable Entering	3.298549
Probability Level	0.080060
Percent Variance Accounted For	10.538989
Standard Error of Predicted Y	7.681296

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	1.	194.622	194.622	3.299	0.080057
Resid	28.	1652.065	59.002		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.324638	0.093568	0.051519

Constant = 46.403

****Step No. 2

Variable Entering	8
F Value For Variable Entering	0.663865
Probability Level	0.422296
Percent Variance Accounted For	12.685835
Standard Error of Predicted Y	7.727822

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	2.	234.268	117.134	1.961	0.160180
Resid	27.	1612.420	59.719		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.293701	0.084651	0.052973
8	0.149752	0.047764	0.058622

Constant = 45.027

****Step No. 3

Variable Entering	6
F Value For Variable Entering	0.308520
Probability Level	0.583317
Percent Variance Accounted For	13.709765
Standard Error of Predicted Y	7.828720

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	3.	253.177	84.392	1.377	0.271839
Resid	26.	1593.511	61.289		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.280163	0.080749	0.054123
6	0.107191	0.029632	0.053348
8	0.119760	0.038198	0.061834

Constant = 43.957

****Step No. 4

Variable Entering	5
F Value For Variable Entering	0.257218
Probability Level	0.616466
Percent Variance Accounted For	14.588540
Standard Error of Predicted Y	7.943004

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	4.	269.405	67.351	1.068	0.393296
Resid	25.	1577.283	63.091		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.272255	0.078470	0.055097
5	0.094972	0.025529	0.050337
6	0.104198	0.028804	0.054151
8	0.109731	0.034999	0.063053

Constant = 43.056

****Step No. 5

Variable Entering	7
F Value For Variable Entering	0.083463
Probability Level	0.775137
Percent Variance Accounted For	14.884543
Standard Error of Predicted Y	8.092733

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	5.	274.871	54.974	0.839	0.534980
Resid	24.	1571.816	65.492		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.286583	0.082599	0.057927
5	0.088444	0.023774	0.051644
6	0.118775	0.032834	0.056908
7	-0.066884	-0.019314	0.066852
8	0.135656	0.043268	0.070329

Constant = 43.287

****Step No. 6

Variable Entering	4
F Value For Variable Entering	0.002284
Probability Level	0.962306
Percent Variance Accounted For	14.892995
Standard Error of Predicted Y	8.266380

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	6.	275.027	45.838	0.671	0.674143
Resid	23.	1571.660	68.333		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.283258	0.081641	0.062473
4	0.012814	0.003810	0.079719
5	0.080324	0.021592	0.069775
6	0.119525	0.033041	0.058290
7	-0.066347	-0.019159	0.068364
8	0.136510	0.043540	0.072064

Constant = 43.234

****Step No. 7

Variable Entering	3
F Value For Variable Entering	0.001640
Probability Level	0.068107
Percent Variance Accounted For	14.899337
Standard Error of Predicted Y	8.451850

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	7.	275.144	39.306	0.550	0.787232
Resid	22.	1571.543	71.434		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.285980	0.082426	0.066747
3	-0.011180	-0.003312	0.081790
4	0.017459	0.005191	0.088353
5	0.082202	0.022097	0.072422
6	0.119375	0.033000	0.059607
7	-0.067143	-0.019388	0.070127
8	0.139175	0.044390	0.076611

Constant = 43.293

****Step No. 8

Variable Entering	1
F Value For Variable Entering	0.000544
Probability Level	0.981713
Percent Variance Accounted For	14.901543
Standard Error of Predicted Y	8.650632

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	8.	275.185	34.398	0.460	0.870435
Resid	21.	1571.502	74.833		
Total	29.	1846.687			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.007222	0.002543	0.109032
2	0.287196	0.082776	0.069949
3	-0.014469	-0.004287	0.093562
4	0.018692	0.005558	0.091788
5	0.080572	0.021658	0.076471
6	0.121153	0.033491	0.064544
7	-0.066301	-0.019145	0.072529
8	0.135292	0.043152	0.094702

Constant = 43.234

****No Further Steps Required End of This Job

APPENDIX C

APPENDIX C

Stepwise Regression Route 3 A Dixon Mulro6 June 69

No. of Format Cards = 1
No. of Observations = 29
No. of Variables = 10
P Level To Add Variable = 1.000
P Level to Delete Variable = 1.000
Format (3X,8F2.0,3X,2F2.0)

RT3 English

No. of Predictors = 8
Criterion = Variable 9
New Designation of Criterion Variable = 9
Original Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	8
F Value for Variable Entering	14.546864
Probability Level	0.000722
Percent Variance Accounted For	35.013138
Standard Error of Predicted Y	5.416604

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	1.	426.799	426.799	14.547	0.000722
Resid	27.	792.169	29.340		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
8	0.591719	0.249741	0.065479

Constant = 39.782

****Step No. 2

Variable Entering	2
F Value For Variable Entering	1.786762
Probability Level	0.192895
Percent Variance Accounted For	39.191971
Standard Error of Predicted Y	5.339369

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	2.	477.738	238.869	8.379	0.001554
Resid	26.	741.231	28.509		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.220318	0.067575	0.050554
8	0.509551	0.215061	0.069565

Constant = 38.749

****Step No. 3

Variable Entering	5
F Value For Variable Entering	3.134598
Probability Level	0.088839
Percent Variance Accounted For	45.966858
Standard Error of Predicted Y	5.132822

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	3.	560.322	186.774	7.089	0.001321
Resid	25.	658.647	26.346		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.377186	0.115689	0.055680
5	-0.299886	-0.081956	0.046290
8	0.419459	0.177037	0.070238

Constant = 42.699

****Step No. 4

Variable Entering	3
F Value For Variable Entering	1.285072
Probability Level	0.268144
Percent Variance Accounted For	48.713013
Standard Error of Predicted Y	5.103805

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	4.	593.797	148.449	5.699	0.002267
Resid	24.	625.172	26.049		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
2	0.483275	0.148228	0.062364
3	-0.196019	-0.049336	0.043522
5	-0.300334	-0.082079	0.046029
8	0.343577	0.145010	0.075339

Constant = 45.215

****Step No. 5

Variable Entering	1
F Value For Variable Entering	0.740266
Probability Level	0.398433
Percent Variance Accounted For	50.312241
Standard Error of Predicted Y	5.131648

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	5.	613.291	122.658	4.658	0.004406
Resid	23.	605.678	26.334		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.147139	0.047385	0.055074
2	0.446776	0.137033	0.064040
3	-0.195649	-0.049243	0.043759
5	-0.351398	-0.096034	0.049040
8	0.335295	0.141514	0.075859

Constant = 44.499

****Step No. 6

Variable Entering	4
F Value For Variable Entering	0.621298
Probability Level	0.438947
Percent Variance Accounted For	51.676926
Standard Error of Predicted Y	5.174424

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	6.	629.926	104.988	3.921	0.008156
Resid	22.	589.043	26.775		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.140935	0.045387	0.055591
2	0.421041	0.129140	0.065346
3	-0.210886	-0.053078	0.044391
4	0.132493	0.030709	0.038960
5	-0.370786	-0.101332	0.049904
8	0.379236	0.160060	0.080028

Constant = 43.304

****Step No. 7

Variable Entering	6
F Value For Variable Entering	0.570499
Probability Level	0.458414
Percent Variance Accounted For	52.954971
Standard Error of Predicted Y	5.225686

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	7.	645.505	92.215	3.377	0.014212
Resid	21.	573.464	27.308		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.129660	0.041756	0.056347
2	0.423813	0.129990	0.066002
3	-0.222618	-0.056031	0.045001
4	0.148416	0.034399	0.039648
5	-0.325410	-0.088932	0.053005
6	0.122439	0.036418	0.048215
8	0.382186	0.161305	0.080837

Constant = 40.292

****Step No. 8

Variable Entering	7
F Value For Variable Entering	0.144035
Probability Level	0.708281
Percent Variance Accounted For	53.291367
Standard Error of Predicted Y	5.335557

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	8.	649.605	81.201	2.852	0.027305
Resid	20.	569.364	28.468		
Total	28.	1218.969			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	0.131710	0.042416	0.057558
2	0.402133	0.123340	0.069631
3	-0.204950	-0.051584	0.047418
4	0.148471	0.034412	0.040481
5	-0.344651	-0.094190	0.055865
6	0.104238	0.031004	0.051254
7	0.073814	0.024779	0.065289
8	0.357095	0.150715	0.087126

Constant = 40.407

****Nor Further Steps Required End of This Job

RT3 Social

No. of Predictors = 8
Criterion = Variable 10
New Designation of Criterion Variable = 9
Original Designation of Predictor Variables = 1 2 3 4 5 6 7 8
New Designation of Predictor Variables = 1 2 3 4 5 6 7 8

****Step No. 1

Variable Entering	8
F Value For Variable Entering	6.475142
Probability Level	0.016968
Percent Variance Accounted For	19.343124
Standard Error of Predicted Y	6.161249

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	1.	245.803	245.803	6.475	0.016968
Resid	27.	1024.947	27.961		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
8	0.439808	0.189527	0.074481

Constant = 43.359

****Step No. 2

Variable Entering	5
F Value For Variable Entering	1.787904
Probability Level	0.192748
Percent Variance Accounted For	24.532684
Standard Error of Predicted Y	6.073273

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	2.	311.749	155.875	4.226	0.025754
Resid	26.	959.001	36.885		
Total	28	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
5	0.229080	0.063922	0.047805
8	0.463937	0.199925	0.073828

Constant = 39.704

****Step No. 3

Variable Entering	3
F Value For Variable Entering	0.926689
Probability Level	0.344919
Percent Variance Accounted For	27.230087
Standard Error of Predicted Y	6.081852

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	3.	346.027	115.342	3.118	0.044011
Resid	25.	924.723	36.989		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
3	0.172471	0.044322	0.046042
5	0.186967	0.052170	0.049405
8	0.491413	0.211765	0.074949

Constant = 37.675

****Step No. 4

Variable Entering	4
F Value For Variable Entering	0.605132
Probability Level	0.444211
Percent Variance Accounted For	29.019760
Standard Error of Predicted Y	6.130461

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	4.	368.769	92.192	2.453	0.073306
Resid	24.	901.981	37.583		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
3	0.201690	0.051831	0.047403
4	-0.149483	-0.035375	0.045475
5	0.222342	0.062041	0.051391
8	0.457102	0.196979	0.077902

Constant = 38.868

****Step No. 5

Variable Entering	1
F Value For Variable Entering	0.161757
Probability Level	0.6 1231
Percent Variance Accounted For	29.515472
Standard Error of Predicted Y	6.240407

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	5.	375.068	75.014	1.926	0.128794
Resid	23.	895.682	38.943		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	-0.080454	-0.026454	0.065775
3	0.208101	0.053478	0.048427
4	-0.143358	-0.033925	0.046431
5	0.255994	0.071431	0.057286
8	0.472682	0.203693	0.081037

Constant = 39.078

****Step No. 6

Variable Entering	6
F Value For Variable Entering	0.022434
Probability Level	0.882265
Percent Variance Accounted For	29.587280
Standard Error of Predicted Y	6.377407

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	6.	375.981	62.663	1.541	0.211615
Resid	22.	894.769	40.671		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	-0.083023	-0.027299	0.067455
3	0.205553	0.052823	0.049683
4	-0.139505	-0.033014	0.047839
5	0.266920	0.074480	0.061981
6	0.029017	0.008812	0.058833
8	0.473699	0.204131	0.082868

Constant = 38.343

****Step No. 7

Variable Entering	7
F Value For Variable Entering	0.032469
Probability Level	0.858699
Percent Variance Accounted For	29.695984
Standard Error of Predicted Y	6.522444

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	7.	377.362	53.909	1.267	0.313075
Resid	21.	893.388	52.542		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	-0.082266	-0.027050	0.069003
3	0.200055	0.051411	0.051414
4	-0.138114	-0.032684	0.048961
5	0.280582	0.078292	0.066828
6	0.038878	0.011807	0.062424
7	-0.040610	-0.013919	0.077245
8	0.493264	0.212563	0.096811

Constant = 38.180

****Step No. 8

Variable Entering	2
F Value For Variable Entering	0.026594
Probability Level	0.872064
Percent Variance Accounted For	29.789352
Standard Error of Predicted Y	6.679077

Analysis of Variance Table

Source	DF	SS	MS	F	P
Regres	8.	378.548	47.319	1.061	0.427165
Resid	20.	892.202	44.610		
Total	28.	1270.750			

Regression Weights

Variables	Standard Weight	Weight	Standard Error
1	-0.089255	-0.029348	0.072051
2	0.045390	0.014215	0.087164
3	0.182659	0.046940	0.059358
4	-0.143189	-0.033886	0.050675
5	0.272167	0.075944	0.069932
6	0.041836	0.012705	0.064160
7	-0.050395	-0.017273	0.081730
8	0.476057	0.205148	0.109065

Constant = 38.515

****No Further Steps Required End of This Job